Text table 6-11.
Academic patenting and licensing activities

	1991	1992	1993	1994	1995	1996	1997
Finances (millions of dollars)							
Gross royalties	$130.0	$172.4	$242.3	$265.9	$299.1	$365.2	$482.9
New research funding from licenses	NA	NA	NA	$106.3	$112.5	$155.7	$136.2
Royalties paid to others	NA	NA	$19.5	$20.8	$25.6	$28.6	$36.2
Unreimbursed legal fees expended	$19.3	$22.2	$27.8	$27.7	$34.4	$46.5	$55.5
Invention disclosures, patent applications, patents							
Invention disclosures received	4,880	5,700	6,598	6,697	7,427	8,119	9,051
New patent applications filed	1,335	1,608	1,993	2,015	2,373	2,734	3,644
Total new patents received	NA	NA	1,307	1,596	1,550	1,776	2,239
Licenses, options, startup companies							
Startup companies formed	NA	NA	NA	175	169	184	258
Number of revenue-generating licenses, options	2,210	2,809	3,413	3,560	4,272	4,958	5,659
New licenses and options executed	1,079	1,461	1,737	2,049	2,142	2,209	2,707
Equity licenses and options	NA	NA	NA	NA	99	113	203
Survey coverage							
Number of institutions responding	98	98	117	120	127	131	132
Percent of total academic R&D represented	65	68	75	76	78	81	82
Percent of federally funded academic R&D represented	79	82	85	85	85	89	90
Percent of academic patents represented	NA	NA	80	89	82	82	91

NA = not available

NOTE: New research funding from licenses is defined as research funds directly related to signing of a specific license agreement.

SOURCE: Association of University Technology Managers, Inc. (AUTM), *AUTM Licensing Survey, Fiscal Year 1991–Fiscal Year 1997* (Norwalk, CT: 1998).

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♦ The number of startups and of licenses and options granted increased strongly. Forty-one percent of new licenses and options went to large firms, 48 percent to small existing companies, and 11 percent to startups.

Conclusion

Over the past decade, the academic research and development enterprise has enjoyed strong growth. It continues to perform approximately half of U.S. basic research and is a major contributor to the nation's and the world's stock of scientific knowledge. Such knowledge appears to be increasingly tied to economic benefits. In turn, an increasingly technologically oriented economy is likely to place a premium on highly educated workers. Nevertheless, U.S. higher education is facing a number of challenges, some arising from within science and engineering, others from changes in the academic environment.

Higher education's overall financial environment has improved somewhat when compared to the recession years at the decade's turn, when many state governments combined flat or reduced appropriations with new accountability measures. Years of steep and unpopular increases in tuition and fees appear to lie in the past as well. Nevertheless, the Nation's universities and colleges continue to face cost pressures, even as nontraditional providers of teaching and training try to capture a growing share of traditional academic markets.

For many of the largest universities, a major uncertainty arises from the restructuring of the Nation's health care system. Some have responded by making structural changes in the relationships with their teaching hospitals, including one of turning them into for-profit ventures. Federal reimbursement changes are feared by many to have adverse effects on biomedical and clinical research and teaching.

For support of their R&D, academic institutions continue to rely heavily on the Federal Government, thus maintaining a certain dependence on implicit Federal priorities for the funding balance among fields. Universities' own resources are approaching one-fifth of their total R&D expenditures. However, in the face of financial pressures on all academic operations, this funding source cannot be expected to continue growing as a share of total academic R&D resources. Industry is often viewed as a potentially growing support source but has continued to supply less than 10 percent of the total funds, even as it has increasingly relied on academic R&D.

Demographic projections point to strong enrollment growth over the next decade and the continuation of several trends: more minority participation, growing numbers of older students, and greater proportions of non-traditional students. Issues of access, affordability, and fairness are likely to mix with considerations of institutional focus, mission, and strategy. Financial and other pressures will be part of the context in which they will unfold; undoubtedly, so will new service possibilities offered by technological developments, which carry their own costs and challenges.

These discussions will take place against the backdrop of increasing faculty retirements. As older faculty are leaving academia, hiring of young scientists and engineers can be expected to pick up further. However, the longer-term structure of this hiring is uncertain. Current trends suggest slower growth of the faculty segment than of other types of academic employment. Will universities and colleges shift the focus of their replacement hiring from tenure-track faculty positions into other, more flexible types of appointments?

The nature and goals of both undergraduate and graduate education are being debated. Are the current models appropriate, or should undergraduate education and graduate training allow for broader and more varied application of skills in the marketplace? Should graduate students be given more autonomy from their professors, perhaps by way of restructuring their modes of support? What is the appropriate role for the Federal Government in this support? Continued increases in the number of foreign students, vital for many graduate programs, cannot be taken for granted. Issues about the nature of graduate education join with questions of university missions and program organization.

The research universities are valued as a national resource: they educate and train large proportions of the Nation's scientists and engineers, embody the model of integrated graduate training and research, and conduct much of the nation's basic research. Yet questions abound. Is their graduate training developing a high-quality yet flexible workforce of scientists and engineers? Is it driven too much by research? Is their research enterprise too insular? Too driven by external demands from the Federal Government or industry? Does it cost too much? How can research be better connected to undergraduate education? With growing research involvement, smaller academic research performers face these same questions.

Answers to these and other questions will emerge gradually, as individual institutions respond to the challenges and opportunities they perceive. The Nation's universities and colleges have shown great ability to adapt to changed realities. In time, it will become possible to take stock of the changes and assess their extent. Many issues underlying these changes will persist, as higher education institutions try to find the appropriate balance among their many evolving functions.

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